SYEN 3379. Homework 01
Assigned 1/16/15

We're going to build a potato launcher. An average potato has a mass of 230 g.

The formula for kinetic energy is $E_k = \frac{1}{2} m_p v^2$ and the formula for range is $R = \frac{v^2}{g} \sin(2\theta)$ where $g = 9.8 \frac{\mathrm{m}}{\mathrm{s}^2}$ and θ is the launch angle. For purposes of design, assume you have made it so that you pick the optimum launch angle of $\frac{\pi}{4}$ radians and you convert potential energy to kinetic energy with 100% efficiency. Thus, $R = \frac{2 E_p}{m_p g}$.

Pick four sources of potential energy (elevate a mass $E_p = m g h$, spin up a flywheel $E_k = \frac{1}{2} J \omega^2$, pressurize a cylinder $E_p = P V$, stretch/compress a spring $E_p = \frac{1}{2} k x^2$ or $E_p = \frac{1}{2} k \theta^2$) and apply reasonable assumptions formed by the constraint that the device must fit into a 1 m x 1 m x ½ m box when it is latched and loaded.

What is the maximum theoretical range for this energy storage method?

What are some practical problems associated with achieving this maximum theoretical range based on limits on cost, materials, and time?

What would be the best method to try for your potato launcher?